Reverberation Workshop Problems

3 April 06

[All equation numbers refer to Scattering_models5.doc.]

Problem I (2-D Monostatic Physics-Based Bottom Roughness Reverb)

Two-dimensional problem. Range independent. Monostatic in range geometry. Isovelocity waveguide. Fast bottom. Two bottom roughness conditions: "Rough bottom" and "typical sand bottom." Ensemble of 1-D finite bottom roughness realizations supplied. Commensurate bottom scattering kernel given by Eq. (38) and coherent coherent reflection coefficient supplied. Require solution of time evolution of average intensity either by Monte Carlo average of time series estimates for ensemble of realizations or via use of reverberation model using supplied scattering kernel. Frequencies (f) of 250, 1000, and 3500 Hz, and Gaussian shaded 3-dB bandwidths of f/20.

Problem II (2-D Monostatic Physics-Based Sea Surface Scattering Reverb)

Two-dimensional problem. Range independent. Monostatic in range geometry. Isovelocity waveguide. Fast bottom. Ensemble of 1-D finite sea surface roughness realizations supplied. Commensurate surface scattering kernel given by Eq. (13) and coherent reflection coefficient given by Eq. (17) supplied. Solution required as in Problem I.

Problem III (2-D Monostatic Physics-Based Sea Surface AND bottom Scattering Reverb)

Two-dimensional problem. Range independent. Monostatic in range geometry. Isovelocity waveguide. Fast bottom. Solution for simultaneous presence of bottom roughness (two roughness conditions) from Prob I and sea surface roughness from Prob II sought (multiple scattering and scattering-scattering interactions).

Problem IV (2-D Range Dependent Monostatic Physics-Based Bottom Roughness Reverb)

Two-dimensional problem. Wedge environment. Monostatic in range geometry. Isovelocity waveguide. Fast bottom with two roughness conditions as in Prob. I. Ensemble of 1-D finite bottom roughness realizations supplied. Commensurate bottom scattering kernel given by Eq. (24) and coherent reflection coefficient supplied. Require solution of time evolution of average intensity either by Monte Carlo average of time series estimates for ensemble of realizations or via use of reverberation model using supplied scattering kernel. Frequencies of 250, 1000, and 3500 Hz, and Gaussian shaded 3-dB bandwidths of f/20.

Problem V (3-D Monostatic Physics-Based Bottom Roughness Reverb)

Three-dimensional problem. Range independent. Monostatic in range geometry. Isovelocity waveguide. Fast bottom with two roughness conditions. Commensurate bottom scattering kernel given by Eq. (20) and reflection coefficient given by Eq. (43) supplied.. Solution required as in Prob I. Alternate Gaussian shaded 3-dB bandwidth of f/5 optional.

Problem VI

As Problem V with summer profile.

Problem VII

As Problem V with winter profile.

Problem VIII (3-D Monostatic Physics-Based Sea-Surface Roughness Reverb)

Three-dimensional problem. Range independent. Monostatic in range geometry. Isovelocity waveguide. Fast bottom. Commensurate surface scattering kernel given by Eq. (2) and coherent reflection coefficient given by Eq. (16) supplied. Solution required as in Prob. I. Alternate Gaussian shaded 3-dB bandwidth of f/5 optional.

Problem IX

As Problem VIII with summer profile.

Problem X

As Problem VIII with winter profile.

Problem XI (3-D Monostatic Lambert's Law)

Three-dimensional problem. Range independent. Monostatic in range geometry. Isovelocity waveguide. Fast bottom. Lambert's law bottom scattering kernel. Require solution of time evolution of average intensity via use of reverberation model using Lambert's law scattering kernel. Frequencies of 250, 1000, and 3500 Hz, and Gaussian shaded 3-dB bandwidth of f/20. Alternate Gaussian shaded 3-dB bandwidth of f/5 optional.

Problem XII

As Problem XI with summer profile.

Problem XIII

As Problem XI with winter profile.

Problem XIV (3-D Bistatic Physics-Based Roughness Reverb)

Three-dimensional problem. Range independent. Bistatic in range geometry. Isovelocity waveguide. Fast bottom. Commensurate bistatic bottom scattering kernel and coherent reflection coefficient as in Prob. V. Solution required as in Prob I. Alternate Gaussian shaded 3-dB bandwidth of f/5 optional.

Problem XV (3-D Bistatic Lambert's Law)

Three-dimensional problem. Range independent. Bistatic in range geometry. Isovelocity waveguide. Fast bottom. Lambert's law bottom scattering kernel. Require solution of time evolution of average intensity via use of reverberation model using Lambert's law scattering kernel. Frequencies of 250, 1000, and 3500 Hz, and Gaussian shaded 3-dB bandwidth of f/20. Alternate Gaussian shaded 3-dB bandwidth of f/5 optional.

Problem XVI (3-D Range-Dependent Monostatic Physics-Based Roughness Reverb)

Three-dimensional problem. Wedge environment. Monostatic in range geometry. Isovelocity waveguide. Fast bottom. Commensurate bottom scattering kernel and coherent reflection coefficient supplied as in Prob. V. Solution required as in Prob I for reverberation from upslope and down slope, as resolved by a horizontal beampattern. Alternate Gaussian shaded 3-dB bandwidth of f/5 optional.

Problem XVII (3-D Range-Dependent Monostatic Lambert's Law)

Three-dimensional problem. Wedge environment. Monostatic in range geometry. Isovelocity waveguide. Fast bottom. Lambert's law bottom scattering kernel. Require solution of time evolution of average intensity via use of reverberation model using Lambert's law scattering kernel. Reverberation from upslope and downslope, as resolved by a horizontal beam pattern, at frequencies of 250, 1000, and 3500 Hz. Gaussian shaded 3-dB bandwidth of f/20. Alternate Gaussian shaded 3-dB bandwidth of f/5 optional.

Problem XVIII (3-D Range-Dependent Bistatic Physics-Based Roughness Reverb)
Three-dimensional problem. Wedge environment. Bistatic in range geometry. Isovelocity waveguide. Fast bottom. Commensurate bistatic bottom scattering kernel and coherent reflection coefficient as in Prob. V. Solution required as in Prob I for a dense sample of horizontal angles, as resolved by a horizontal line array. Alternate Gaussian shaded 3-dB bandwidth of f/5 optional.

Problem XIX (3-D Range-Dependent Bistatic Lambert's Law)

Three-dimensional problem. Wedge environment. Bistatic in range geometry. Isovelocity waveguide. Fast bottom. Lambert's law bottom scattering kernel. Require solution of time evolution of average intensity via use of reverberation model using Lambert's law scattering kernel. Reverberation from a dense sample of horizontal angles, as resolved by a horizontal line array, at frequencies of 250, 1000, and 3500 Hz. Gaussian shaded 3-dB bandwidth of f/20. Alternate Gaussian shaded 3-dB bandwidth of f/5 optional.

Problem XX (3-D Range-Dependent Bistatic Lambert's Law)

Three-dimensional problem. Harrison wedge into shelf environment. Bistatic in range geometry. Isovelocity waveguide. Fast bottom. Lambert's law bottom scattering kernel. Require solution of time evolution of average intensity via use of reverberation model using Lambert's law scattering kernel. Reverberation from a dense sample of horizontal angles, as resolved by a horizontal line array, at frequencies of 250, 1000, and 3500 Hz. Gaussian shaded 3-dB bandwidth of f/20. Alternate Gaussian shaded 3-dB bandwidth of f/5, f/2 and f optional.

Bottom roughness	**Surface roughness**	**Lambert**
2D MSRI (Iso)	**2D MSRI (Iso)**	
3D MSRI(Iso, Sum,Win)	**3D MSRI (Iso, Sum,Win)**	**3D MSRI (Iso,Sum,Win)**
3D BSRI (Iso)	**3D BSRI (Iso)**	**3D BSRI (Iso)**
3D MSRD (Iso)		**3D MSRD (Iso)**
3D BSRD (Iso)		**3D BSRD (Iso)**

Key

MSRI **Laterally monostatic source-receiver geometry, range-independent environment**
BSRI **Laterally bistatic source-receiver geometry, range-independent environment**
MSRD **Laterally monostatic source-receiver geometry, range-dependent environment**
BSRD **Laterally bistatic source-receiver geometry, range-dependent environment**
Iso **Isovelocity waveguide**
Sum **Downward refracting waveguide**
Win **Upward refracting waveguide**